



Description and Objectives

A castable epoxy with uniformly dispersed boron coated polyethylene particles and an integrated thermal protection system (TPS) will provide a multi-functional, lightweight structural material for:

- ◆ Shielding against Galactic Cosmic Rays and Solar Energetic Particles via Polyethylene Particles in an Epoxy Matrix.
- ◆ Shielding against Secondary Neutrons via Boron Coated Particles.
- ◆ Thermal and impact resistance via integrated TPS.
- ◆ Can be repaired with ease without significantly compromising mechanical properties of the material.
- ◆ Dispersion of a single particulate phase to give shielding capability is less challenging compared to incorporating continuous fibers or several types of particles in a composite.



**Radiation Shielding Composite
Mechanical Testing Samples: (L-R)**

Unfilled Epoxy,
10% Polyethylene Particles in Epoxy,
20% Polyethylene Particles in Epoxy,
10% Boron Coated Polyethylene
Particles in Epoxy. (Volume %)

ASTM D-638 Type I Tensile
Specimens

Approach

- Select the most promising types of epoxy, polyethylene, and boron.
- Optimize coating methods to maximize adhesion between the polyethylene particles, boron coating, and epoxy matrix.
- Optimize the percentage of loading in the epoxy composite to satisfy both radiation shielding and mechanical strength requirements.
- Develop integrated TPS to provide thermal and impact protection.
- Perform mechanical, thermal, and radiation testing to characterize the optimized composite and thermally protected (TPS) composite systems
- Produce prototype radiation shielding panels of the optimized composite and TPS composite for delivery to NASA.

Subcontractor

BAE SYSTEMS Analytical Solutions, Inc.

Schedule and Deliverables

- 12 months for process optimization and fabrication of test articles.
- 16 months for comprehensive baseline material characterization.
- 24 months for development and testing of integrated TPS.
- Deliverables: 2 Prototype radiation shielding panels – 1 optimized composite, 1 optimized composite with integrated TPS.

NASA and Commercial Applications

- Improved radiation shielding for space transportation vehicles, orbiters, landing vehicles, rovers, habitats.
- Repair shielding in space transportation/landing vehicles, habitats
- Commercial Applications Include: particle accelerators, nuclear reactors, radioactive biological and nuclear waste containment vessels, satellite hardware shielding, high-altitude fighter planes